3-31 TABULAR METHOD TO CALCULATE VARIANCE AND STD. DEV.

FORMULA: $VAR = \frac{\Sigma(x-\bar{x})^2}{n-1}$

$STD.DEV. = \sqrt{VAR}$

(1) EXAMPLE: 1, 1, 1, 2, 3, 4, 4, 4, 5, 5 $n=10$ $\bar{X} = \frac{30}{10} = 3$

X	$\bar{X}$	$x-\bar{x}$	$(x-\bar{x})^2$
1	3	-2	4
1	3	-2	4
1	3	-2	4
2	3	-1	1
3	3	0	0
4	3	1	1
4	3	1	1
4	3	1	1
5	3	2	4
5	3	2	4

$\Sigma(x-\bar{x})^2 = 24$

$VAR. = \frac{24}{10-1} = \boxed{2.67}$

$STD.DEV. = \sqrt{VAR} = \sqrt{2.67} = \boxed{1.63}$

USING THE STAT MODE ON THE TI-30Xa

ENTER EACH DATUM FOLLOWED BY $\boxed{\Sigma+}$

THEN HIT $\boxed{2^{nd}}$ $\overset{\sigma_{x_{n-1}}}{\boxed{\sqrt{x}}}$ $\Rightarrow$ $\boxed{1.63}$

FOR $VAR. = (STD.DEV)^2$
$= (1.63)^2 = \boxed{2.67}$

A CONTINUOUS DATA EXAMPLE

(2) DATA: 1.5, 1.7, 1.8, 2.2, 3.3, 4.5

$n = 6$

$\bar{x} = \frac{15}{6} = 2.5$

x	$\bar{x}$	$x - \bar{x}$	$(x-\bar{x})^2$
1.5	2.5	-1	1
1.7	2.5	-0.8	0.64
1.8	2.5	-0.7	0.49
2.2	2.5	-0.3	0.09
3.3	2.5	0.8	0.64
4.5	2.5	2	4

$\Sigma(x-\bar{x})^2 = 6.86$

$VAR = \frac{6.86}{6-1} = \boxed{1.372}$

$STD.DEV. = \sqrt{1.372} \boxed{= 1.17}$

MEASURE OF SYMMETRY - SKEWNESS sk

$sk < \emptyset$ TAIL TO LEFT

$sk \cong \emptyset$ SYMMETRIC

$sk > \emptyset$ TAIL TO RIGHT

FORMULA: $sk = \frac{(MEAN - MODE)}{STD.DEV} = \frac{(\bar{x} - MODE)}{\sigma_{x_{n-1}}}$

EXAMPLES:

[redacted] [redacted]

DATA: 1, 1, 2, 3, 4, 4, 5, 5, 5

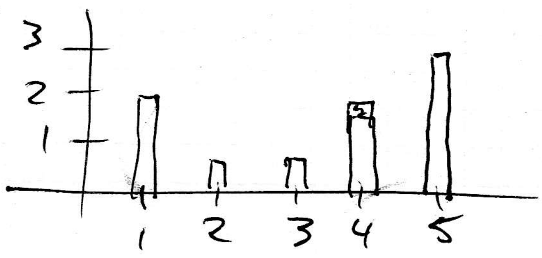
MODE = 5

MEAN = 3.33

STD.DEV. = 1.66

$sk = \frac{(3.33-5)}{1.66} = \boxed{-1}$

TAIL ←



NORMAL DATA AND THE NORMAL CURVE

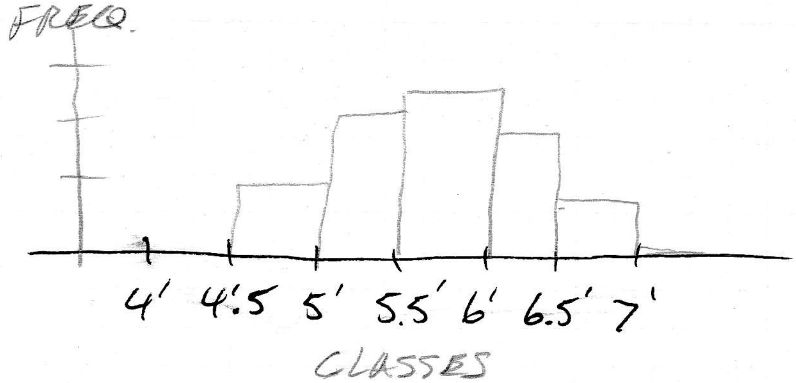
HEIGHT IS A GOOD EXAMPLE

POPULATION: U.S. PEOPLE
PARAMETER: HEIGHT IN FEET AND IN.

SAMPLE: STUDENTS IN A CLASS

VARIABLE: HEIGHT IN ft. AND in.

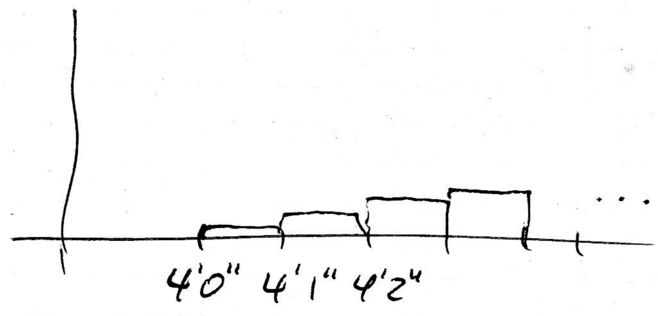
GRAPH:

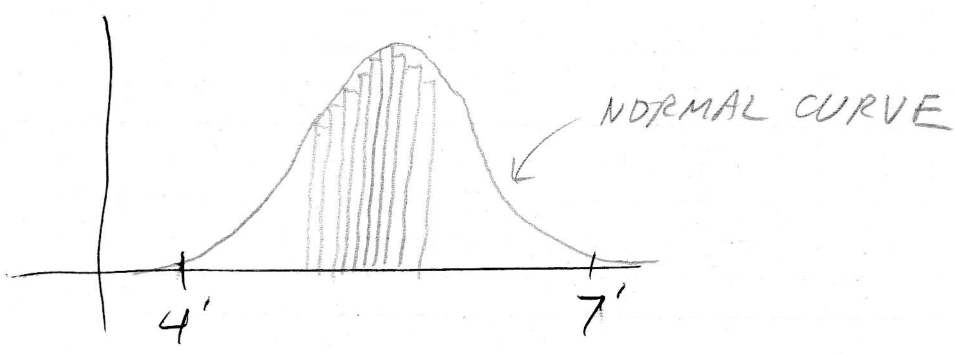


IF CLASS-SIZES ARE TOO SMALL, BARS ARE SPARSE

IF CLASS-SIZES ARE TOO BIG, ONLY ONE BAR

IF SAMPLE IS UCCS POPULATION

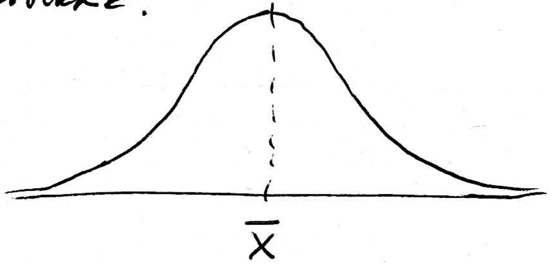




CHARACTERISTICS OF PERFECTLY NORMAL DATA AND ITS CURVE:

- TAILS CONTINUE FOREVER BUT GET VERY CLOSE TO X-AXIS.
- PERFECTLY SYMMETRIC (sk = 0)
- 100% OF THE SAMPLE IS UNDER THE CURVE SOMEWHERE.

50% IS ABOVE AVERAGE,
50% IS BELOW AVERAGE



- PERCENTAGES CAN BE CONVERTED TO FRACTION OF POPULATION

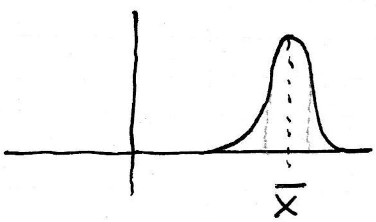
$100\% = 1$ (EVERYBODY)

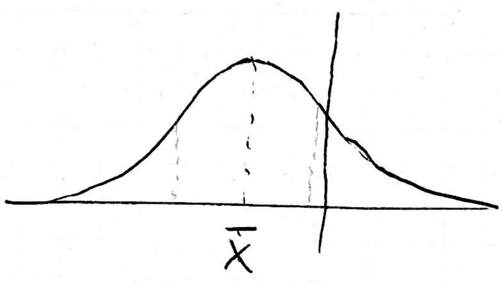
$50\% = \frac{1}{2} = 0.5$

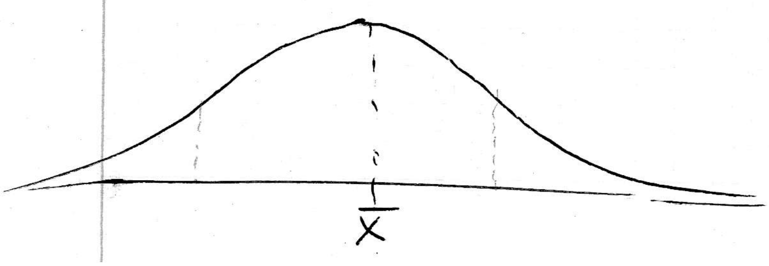
$50\% = \frac{50}{100} = 0.5 \leftarrow 50\%$

ON CALCULATOR: $\boxed{5}$ $\boxed{0}$ $\boxed{2nd}$ $\overset{\%}{\boxed{2}}$

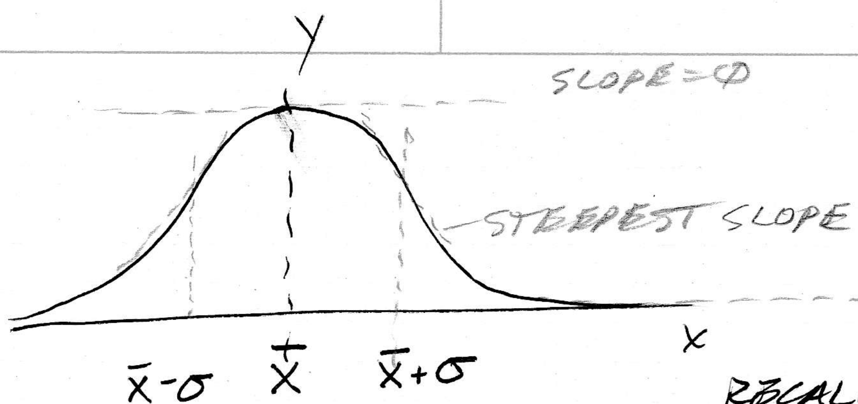
OTHER EXAMPLES OF NORMAL CURVES







ALL HAVE SAME SHAPE



RECALL, σ MEASURES SPREAD OR PRECISION

x̄ MEASURES ACCURACY

THE NORMAL CURVE HAS A FUNCTION WHICH DEFINES IT:

$$y(x) = \frac{1}{\sigma\sqrt{2\pi}}\, e^{\frac{-(x-\bar{x})^2}{2\sigma^2}}$$

(2.1718...)

WE <u>COULD</u> USE THIS TO CALCULATE NUMBERS RELATED TO STATISTICS, BUT WE <u>WON'T</u>.